

Application Serial No. 10/712,840
Amendment dated September 20, 2005
Response to Office Action dated June 28, 2005

Remarks/Arguments

The preceding amendments and following remarks are submitted in response to the non-final Office Action mailed June 28, 2005, setting a three month shortened statutory period for response ending September 28, 2005. With this Amendment, claims 11-14 and 18 and 22-24 have been cancelled without prejudice, and claims 29-35 have been added. Claims 1-10, 15-17, 19-21 and 25-35 remain pending in the Application. Reconsideration, examination and allowance of all pending claims are respectfully requested.

On page 2 of the Office Action, the Examiner rejected claims 1-4, 10, 15, 26 and 27 under 35 U.S.C. § 102(b) as being anticipated Anderson et al. (U.S. 6,138,604). While not conceding to the Examiner's rejection, claim 1 has been amended to include the limitations of dependent claims 11, 12 and 14, and dependent claims 11, 12 and 14 have been canceled without prejudice. On page 8 of the Office Action, the Examiner indicated that claim 14 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all the limitations of the base claim and any intervening claims. As such, claim 1 as amended is believed to be in condition for allowance. For similar and other reasons, dependent claims 2-10 are also believed to be in condition for allowance.

Claim 15 has been amended to recite:

15. (Currently Amended) A flexible member comprising:
a spine member having a length;
two three or more plates attached at spaced locations along the length of the spine member, selected plates forming a plate pair, at least some of the plates extending out and forming ribs that support an outer skin of the flexible member;
and

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one or more actuators positioned between and fixed to at least selected plate pairs for creating a push and/or pull force between the corresponding plate pair and to change the relative orientation of the plate pair.

In Anderson et al., the first plate and the second plate (130, 134 and 132, 136) do not extend out and form ribs that support an outer skin of the flexible member. Rather, it appears that plates 54 of Anderson et al. provide the support for the outer skin, and not pivots 130, 134 and 132, 136.

Anderson state:

Afterbody 14 may be made up of one or more flexible battens 50 and 52, FIG. 4, to which are attached a plurality of buoyant foam plates 54 of varying shape to define the shape of the body. Plates 54 contain central holes 56 which define a hollow central core 58 in which the drive structure and drive system are disposed, as will be explained with respect to FIG. 7.

(Anderson et al., column 4, lines 35-41) (Emphasis Added). As can be seen in FIG. 7 of Anderson et al., the drive structure, which includes the pivots 130, 134 and 132, 136, is positioned inside the hollow central core formed by plates 54. Thus, it is clear that pivots 130, 134 and 132, 136 do not extend out and form ribs that support an outer skin of the flexible member, as recited in claim 15. For these and other reasons, claim 15 is believed to be clearly patentable over Anderson et al. For similar and other reasons, dependent claims 16-17, 19-21 and 25-27 are also believed to be clearly patentable over Anderson et al.

On page 4 of the Office Action, the Examiner rejected claims 1-10, 15-17, 19-21 and 25 under 35 U.S.C. § 102(b) as being anticipated Moya et al. (U.S. 5,142,932). As noted above, claim 1 now includes the limitations of dependent claims 11, 12 and 14. On page 8 of the Office Action, the Examiner indicated that claim 14 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all the limitations

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of the base claim and any intervening claims. As such, claim 1 as amended is believed to be in condition for allowance. For similar and other reasons, dependent claims 2-10 are also believed to be in condition for allowance.

Turning now to claim 15, which recites:

15. (Currently Amended) A flexible member comprising:
a spine member having a length;
two three or more plates attached at spaced locations along the length of the spine member, selected plates forming a plate pair, at least some of the plates extending out and forming ribs that support an outer skin of the flexible member;
and
one or more actuators positioned between and fixed to at least selected plate pairs for creating a push and/or pull force between the corresponding plate pair and to change the relative orientation of the plate pair.

Moya et al. do not teach or suggest an outer skin. As such, Moya et al. cannot teach or suggest three or more plates attached at spaced locations along the length of a spine member, wherein at least some of the plates extend out and form ribs that support an outer skin of the flexible member, as recited in claim 15.

In addition, claim 15 recites three or more plates attached at spaced locations along the length of the spine member. According to the Examiner, the spine member corresponds to reference numeral 20. There are three separate spine members 20₁, 20₂, and 20₃ shown in FIG. 1 of Moya et al.; one spine member for each Module 10₁, 10₂, and 10₃. Rather than providing a spine member between Modules 10₁, 10₂, and 10₃, Moya et al. teach to bolt the top plate of one Module to the bottom plate of the next Module, as shown. Applicants do not believe it can readily be argued that the bolt connection between the top plate of one Module and the bottom plate of an adjacent Module is part of spine members 20₁, 20₂, and 20₃. Each of the spine

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members 20₁, 20₂, and 20₃ of Moya et al. only have two plates attached. Thus, Moya et al. cannot teach or suggest a spine member that has three or more plates attached at spaced locations along the length of the spine member, as recited in claim 15. For these and other reasons, claim 15 is believed to be clearly patentable over Moya et al. For similar and other reasons, dependent claims 16-17, 19-21 and 25-27 are also believed to be clearly patentable over Moya.

On page 7 of the Office Action, the Examiner rejected claims 11, 12 and 28 under 35 U.S.C. § 103(a) as being unpatentable over Moya et al. (U.S. 5,142,932) in view of Horning et al. (U.S. 6,646,364). As noted above, claims 11 and 12 have been canceled with prejudice. With respect to claim 28, the Examiner states that Moya et al. fails to teach using an electrostatic actuation means. However, the Examiner states that Horning et al. discloses actuating a device using an array of electrostatically actuated cells. The Examiner then concludes that it would have been obvious to one of ordinary skill in the art at the time the invention was made to use electrostatic unit cell arrays of Horning et al. to actuate the device of Moya et al. since the electrostatic consumes less power and creates less heat.

Applicants must respectfully disagree. Moya et al. clearly teach the use of magnets and electromagnets for actuation of the robotic arm. More specifically, Moya et al. state:

Energization of the circular array of electromagnets 40 and more particularly their respective coils 39 are energized in sets of three coils each as noted above. Circuitry for providing the energization is shown in FIG. 5 and is located in the controller 41. Referring now to FIG. 5, shown thereat are three electromagnet coils 39 connected in series between the collector 72 of an n-p-n transistor 74 and a +V supply potential applied to terminal 76. The transistor 74 comprises the output transistor of an emitter follower circuit configuration including n-p-n transistor 78, the base 80 of which is coupled to an input terminal 82. Terminal 82 is adapted to receive a turn-on signal when energization of the

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coils 39 is required. Resistor 84 acts as the collector load resistor for transistor 78 while resistors 86 and 88 comprise base bias resistors therefor. A diode 90 is further shown coupled in parallel with the three coils 39 and provides a discharge path therefor upon deenergization.

In operation, each of the modules $10_1 \dots 10_n$ is composed of the same basic components as an electric motor having a stator and a rotor except that the stator and rotor are arranged differently and take a different form. In the module 10, the base plate 16 comprises the stator and incorporates both the central permanent magnet 50, the spacer 60, which in actuality comprises a magnetic flux carrier washer, and the circular array of electromagnets 40 comprised of the respective pole pieces 56 and windings 39 arranged around the outer perimeter thereof. The top plate 14 corresponds to a motor rotor. The difference is that it nutates, i.e. has a conical rotation, instead of a rotation about a single centralized axis. Here the top plate 14 conically pivots around the universal joint 20 in response to the instantaneous magnetic state of the base plate 16.

It should also be pointed out that the permanent magnet 50 which also comprises a ring, provides a clamping force between the two plates 14 and 16 and contributes significantly to the torque capability of the device. The torque T, for any point in time, is:

$$T \approx 4CB_{\text{coil}}B_{\text{pm}}(1)$$

where C is a constant that relates to the area and distance from the point of minimum gap to the centroid of the area containing the effective flux density of a coil 39 and B_{pm} is the flux density due to the presence of permanent magnet 50 at that particular location.

Accordingly, when three series connected coils 39 of the sets of electromagnets 40 are energized in a sequential fashion, from the left and right of a point of minimum gap, one set of electromagnets will be pulling on one side of the top plate 14, while the other set will be pushing on the opposite side.

(Moya et al., column 3, line 27 through column 4, line 12) (Emphasis Added). As can be seen,

Moya et al. teach to use three series connected coils 39, and when energized in a sequential fashion, one set of electromagnets will be pulling on one side of the top plate 14, while the other

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set will be pushing on the opposite side. According to Moya et al., this significantly increases the torque capability of the system.

The electrostatically actuated device of Horning et al. is clearly of a different character than the electromagnet system of Moya et al. The electrostatically actuated device of Horning only provides a pulling force, and does not provide a pushing force. According to Moya et al., the pushing/pulling action appears to be highly desirable. As such, it is not believed that there would be any motivation whatsoever for substituting the electrostatic array device of Horning for the electromagnetic system of Moya et al. If anything, Moya et al. would appear to teach away from such a combination. In view thereof, claim 28 is believed to be clearly patentable over Moya et al. in view of Horning et al.

New claim 29 recites the limitations of original claim 1, and dependent claim 13. On page 8 of the Office Action, the Examiner indicated that claim 13 was objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all the limitations of the base claim and any intervening claims. As such, new claim 29 is believed to be in condition for allowance.

New claim 30 recites the limitations of original claim 15, and dependent claim 18. On page 8 of the Office Action, the Examiner indicated that claim 18 was objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all the limitations of the base claim and any intervening claims. As such, new claim 30 is believed to be in condition for allowance.

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New claim 31 recites the limitations of original claim 15, and dependent claim 22. On page 8 of the Office Action, the Examiner indicated that claim 22 was objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all the limitations of the base claim and any intervening claims. The limitations of intervening claim 16 have not been included in new claim 31, as they are not believed to be necessary. Thus, new claim 31 and dependent claim 32 are believed to be in condition for allowance.

New claim 33 recites the limitations of original claim 15, and dependent claim 23. On page 8 of the Office Action, the Examiner indicated that claim 23 was objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all the limitations of the base claim and any intervening claims. As such, new claim 33 and dependent claim 34 are believed to be in condition for allowance.

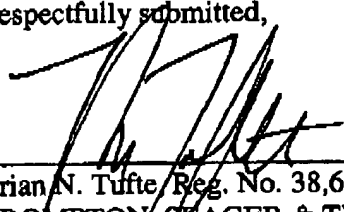
New claim 35 is similar to original claim 1, but further recites that the spine member is a unitary member with no pivot joints. Neither Anderson et al. nor Moya et al. disclose or suggest the use of a spine member that is a unitary member with no pivot joints. As such, new claim 35 is also believed to be clearly patentable over Anderson et al. and Moya et al.

In view of the foregoing, all pending claims 1-10, 15-17, 19-21 and 25-35 are now believed to be in condition for allowance. Reexamination and reconsideration are respectfully requested. If a telephone conference might be of assistance, please contact the undersigned attorney at (612) 359-9348.

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Respectfully submitted,

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